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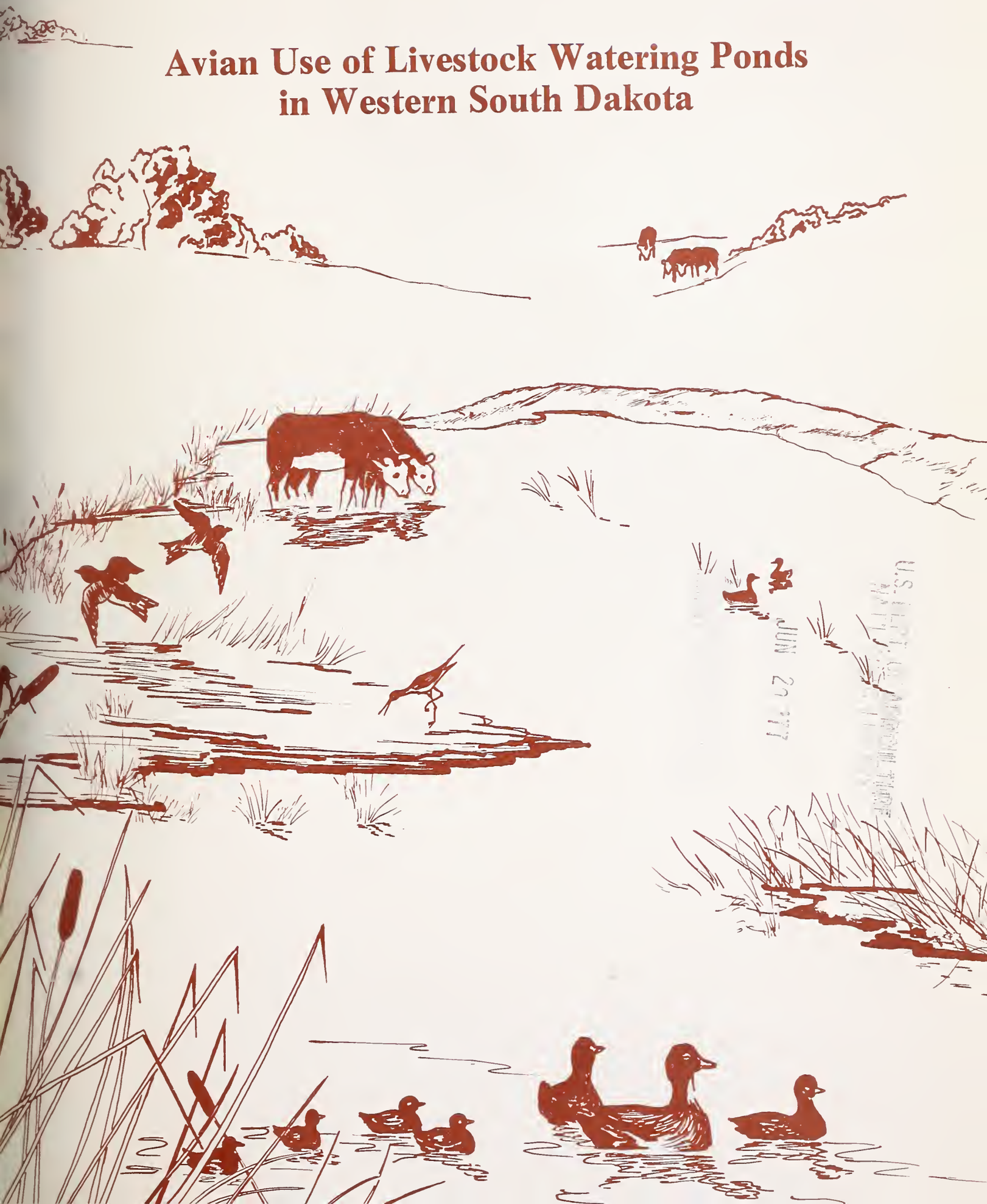
Avian Use of Livestock Watering Ponds in Western South Dakota



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Waterfowl use from 1966 through 1972 peaked during the spring of 1967 when study ponds averaged 29 birds each. The average spring migration peak was 16.5 waterfowl per pond. Mallards and blue-winged teal made up 64 percent of adult waterfowl observed. Spring shorebird numbers peaked approximately 1 month later than waterfowl. The number of puddle duck young per pond during the peak of the brood season averaged 18, and varied from 10 to 24. Over the 7-year study period (1966-1972), 116 species of birds were observed in the area; 66 were upland birds not dependent on water developments. Large ponds (1-11 acres) in rolling topography with gently sloping shorelines, constant water levels, and abundant emergent and submerged vegetation, are best for duck brood production. An evaluation form for duck brood habitat was developed. Management implications and alternatives were discussed.

Keywords: Waterfowl use, duck brood production, wetland habitat.

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Avian Use of Livestock Watering Ponds In Western South Dakota

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Contents

Avian Use of Livestock Watering Ponds in Western South Dakota

Keith E. Evans and Roger R. Kerbs

Background

Few natural ponds exist on the unglaciated portion of the northern Great Plains, but thousands of ponds have been dug in the area since the 1930's to provide water for livestock. Bue et al. (1964) estimated that 220,000 manmade watering ponds dot the landscape of South Dakota, North Dakota, eastern Montana, and western Minnesota. Before these stock ponds were constructed, upland areas near natural water were often overgrazed, and much of the remaining prairie was undergrazed. The livestock watering ponds have achieved two goals: better grazing distribution; and improvement and creation of wetland habitats, particularly suited for waterfowl and shorebirds.

Data in this report were collected from 1966 to 1972 during 113 visits to 12 western South Dakota study ponds. Information presented includes: (1) avian use of ponds; (2) a comparison of waterfowl brood use with pond characteristics; (3) a review of waterfowl food habits; and (4) management implications and alternatives based on data, observations, and literature review. Preliminary results were published in South Dakota Bird Notes (Evans and Kerbs 1967, 1972a). A checklist of birds of the Buffalo Gap National Grasslands included some of these observations (Evans and Kerbs 1972b).

Kuchler (1964) showed the entire study area as a wheatgrass-needlegrass vegetation type. Although the region is classified as a mixed grass prairie, the vegetation in the waterways and drainage systems provides the diversity needed for many of the wildlife species found in the area. The topography of the study area generally is gently rolling (fig. 1) with some fairly steep areas (fig. 2). Some of the study ponds had mudflat shorelines.

The study ponds are located in Jackson County east of Wall, South Dakota. The South Fork Bad River is the main watershed for the area. The dominant land use practice is cattle grazing. Most ranchers in the area run a cow-calf operation.

Prior to 1969, the USDA Forest Service, Buffalo Gap National Grassland, managed the land under a summer-long grazing system. The area around most of the ponds was heavily grazed and dominated by blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), and bare soil. Beginning in 1969, the large pastures were cross-fenced into smaller units, and grazing was changed to a rest-rotation system under management by the Wall District, Nebraska National Forest, in cooperation with the White River Grazing Association.

Figure 1.—Study pond B in gently rolling area.

Figure 2.—Study pond J in area with fairly steep slopes.

Data Collection and Presentation

The study ponds were selected to represent gradients of pond characteristics such as size, depth, shoreline slope, vegetation abundance, and topography (table 1). A standardized route was established so each of the 12 ponds could be observed in 1 day. Observations were made every 2 weeks through the ice-free season of each year from 1966 through 1972. Caution was taken so as not to move birds from one pond to another during the count period. The 12 ponds were believed to be a representative sample of the ponds in the area.

Bird observations were recorded by date, study pond, species, and number of waterfowl and shorebirds. Killdeer[2] numbers were not recorded because they were abundant between ponds as well as near ponds, and not associated with a specific study pond. A nonquantitative checklist of upland birds for the study area was kept by species for each observation period.

[2]*Common names of all birds are from AOU (1957), and 32nd Supplement (1972), thus eliminating the need for scientific names.*

Vegetation characteristics were investigated in two phases: collection and identification of plant species in and around the 12 study ponds (Appendix); and establishment of photo points to document vegetation and physical changes during the study.

Migration

Waterfowl

Waterfowl use began immediately after the spring thaw, about the 15th of March (fig. 3).
Pintails, mallards, common mergansers, and green-winged teal were the first waterfowl to appear on the ponds. By April 1, many species were present. Use peaked during the April 1-15 period, with an average of nearly 17 waterfowl in each pond. The highest use occurred in 1967 when ponds averaged 29 birds each at the peak of spring migration. The years 1966 and 1970 were low-use springs, and in both years the migration peaked during the April 15-30 period. The study ponds seemed best suited for mallards and blue-winged teal; these two species made up 64 percent of the observations (table 2).

Table 1.—Description of study pond characteristics

Pond	Size[1]	Depth		Shoreline		Vegetation[3]						Fish
						Shoreline		Emergent		Aquatic		
		Max.	Ave.	Slope[2]	Length	1966	1972	1966	1972	1966	1972	
	Acres	*Feet*			*Feet*							
A	3.0	7.3	2.5	Flat	2,440	S	S	S	C	S	S	
B	2.25	10.4	4.0	Steep	2,040	C	A	S	S	S	S	Bullhead
C	2.25	5.0	2.0	Flat	2,920	S	A	S	A	C	A	
D	2.0	7.7	4.0	Inter-mediate	2,470	S	C	C	A	C	C	Bullhead, bass to 4 lbs.
E	11.0	8.0	4.0	Inter-mediate	5,590	C	C	C	C	S	C	Bullhead, blue-gill, bass to 4½ lbs.
F	10.0	7.0	3.0	Inter-mediate	4,660	A	C	C	C	C	C	Bullhead
G	7.0	7.5	2.5	Flat	2,720	S	C	S	C	C	A	
H	4.5	8.0	3.0	Inter-mediate	3,750	S	C	S	C	S	C	Bullhead, bass to 2 lbs.
I	7.0	8.0	3.0	Flat	4,340	S	C	S	C	C	C	
J	4.5	11.0	6.0	Steep	3,400	C	C	S	C	C	A	Bullhead
K	1.25	7.6	2.5	Inter-mediate	1,240	S	C	S	C	S	S	
L	3.5	9.0	3.0	Inter-mediate	2,580	S	C	S	C	S	S	Bullhead

[1]Within ¼ acre at high water mark.

[2]Shoreline slope: 1:1 = steep; 1:3 = intermediate; 1:5 = flat.

[3]Vegetation: sparse (S); common (C); abundant (A).

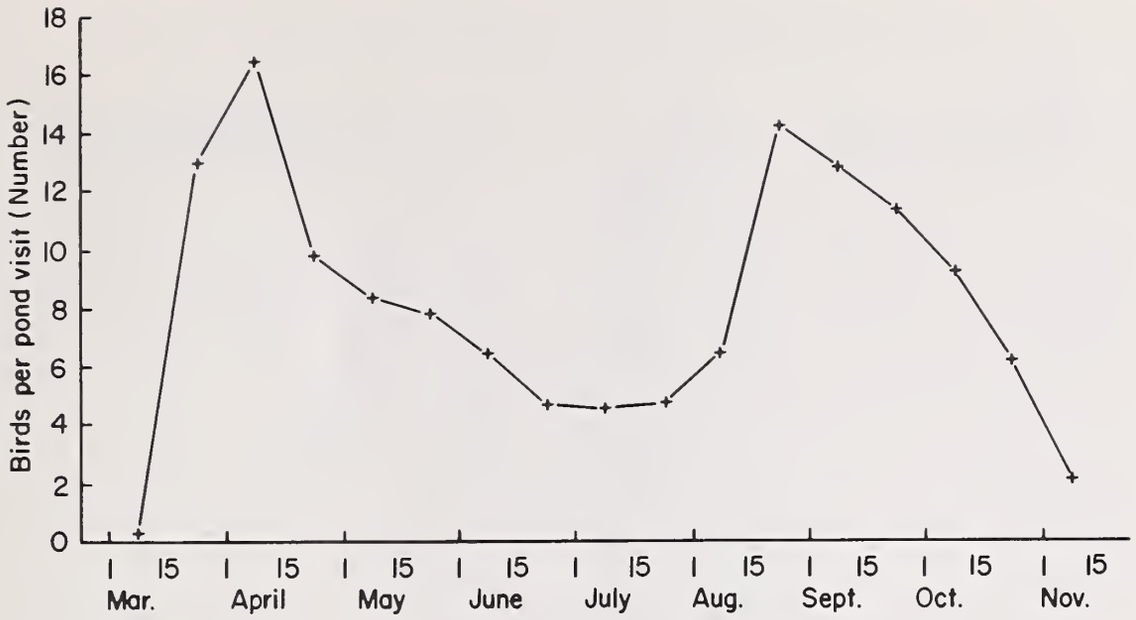

Figure 3.—Waterfowl migration patterns on western South Dakota stock watering ponds.

Table 2.—Relative frequency of the seven most common waterfowl (adults only) on the study ponds.

Species	Pond												Average
	B	J	K	H	A	L	C	D	G	E	I	F	
	— — — — — — *Percent* — — — — — —												
Mallard	56	54	36	40	41	42	45	42	40	38	34	28	41
Blue-winged Teal	21	16	30	24	15	30	21	27	20	22	32	16	23
Green-winged Teal	4	5	9	11	20	9	10	6	4	7	13	16	10
Pintail	4	8	10	11	16	12	11	11	14	5	8	16	10
Gadwall	13	8	10	8	4	3	10	11	8	13	5	8	8
American Widgeon	2	8	4	3	3	2	2	1	12	13	7	13	6
Shoveler	0	1	1	3	1	2	1	2	2	2	1	3	2
Percent of total	2	4	4	5	5	5	10	11	12	13	13	16	

During the brood season, June 16-July 31, populations of adult waterfowl decreased to a low of five birds per pond visit. After August 1, many broods had attained adult size and plumage and were counted as adults. The fall migration peaked between August 15 and September 1. The average peak, which includes both young-of-the-year and adult migrants, reached 14 waterfowl per pond. Fall use was highest in 1967, nearly 30 ducks per pond.

Shorebirds and Other Waterbirds

Shorebirds were an important component of the avifauna on the study ponds. Spring migration peaked later for shorebirds (around May 15, fig. 4) than for waterfowl. Long-billed curlews were the first to appear, usually arriving in early April. Usually no more than 1 or 2 shorebirds were observed on all 12 study ponds during the April 1-15 period. By the May 1-15 observation period, shorebirds were commonly seen on all study ponds that had mudflat shorelines.

The most common shorebird associated directly with the ponds was the Wilson's phalarope. Phalarope nests were found within 50 feet of the shoreline, and phalaropes were observed feeding in shallow water throughout the summer.

Mergansers, coots, grebes, and cormorants were grouped together for analysis. Waterbird spring migration peaked between March 15 and April 1, and frequently included sizable numbers of common mergansers. The peak numbers in the fall were primarily coots and grebes (fig. 4).

Summary

Stock watering ponds were important in the spring and fall as feeding and resting areas for many species of birds. Peak numbers of waterfowl appeared on the ponds between April 1 and April 15, and August 15 and August 31. Shorebird spring migration peaked between May 15 and May 31; "fall" migration peaked between July 15 and July 31.

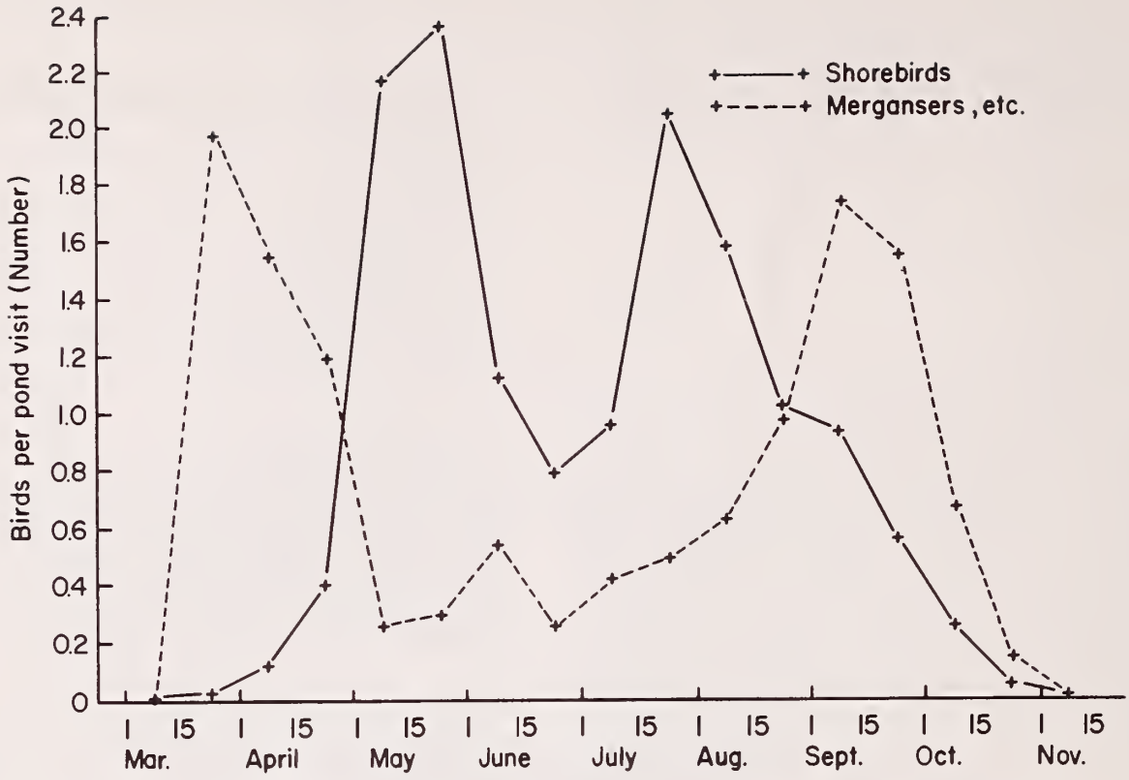

Figure 4.—Migration patterns of shorebirds and mergansers, coots, grebes, and cormorants, on stock watering ponds in western South Dakota.

Over the 7-year study period, 116 species of birds were observed in the vicinity of the study ponds. Sixty-six of these species were not counted but their occurrence was recorded (table 3). Most of these were upland birds that did not depend on water developments.

Production of Young

Waterfowl

Production of young waterfowl was based on the peak number of young observed on each pond during each year. Puddle duck production varied from a low of 10 young per pond in 1969 to a high of 24 in 1967 (table 4). The 7-year average (1966-72) was 18 young per pond. These production estimates are probably conservative, because early and late broods were not included in the count when peak numbers were observed.

Some broods were only observed on one occasion; it is not known whether they moved to another pond, or succumbed to unknown mortality factors. Bue et al. (1952) studied 50 stock ponds in Stanley County, South Dakota, during the summers of 1950 and 1951 and estimated an average of 22 young ducks produced per pond.

The 12 study ponds were quite variable in their value for brood production (table 4). They ranged from an average of 1.9 young per year (less than 1 brood, pond A) to 37.4 young per year (over 5 broods per year, pond I).

Production also varied widely among the 7 study years. Numbers of broods, at the peak of the brood season, ranged from 26 in 1969 to 48 in 1971. Peak numbers of young waterfowl ranged from 119 in 1969 to 287 in 1967. Average brood size fluctuated between 4.6 and 6.5, with a 7-year average of 5.5. Brood numbers usually peaked during July, with an overall average of 3.2 broods per pond year. Lokemoen (1973) reported an average of 0.77 brood per pond in western North Dakota, while Rundquist (1973) reported an average of 4.9 broods per pond on grassland areas in Montana.

Blue-winged teal produced almost half of the young ducks on the study ponds. Six species of puddle ducks produced the other half of the young:

Species	Percent of Total Young
Blue-winged teal	48
Mallard	26
Gadwall	11
Pintail	10
Shoveler	3
Green-winged teal	1
American widgeon	1

Table 3.—Other bird species observed in Jackson County, South Dakota

Species	Year						
	1966	1967	1968	1969	1970	1971	1972
Blackbird, Brewer's		X					X
Red-winged	X	X	X	X	X	X	X
Yellow-headed		X				X	
Bluebird, Mountain				X		X	
Bunting, Lark	X	X	X	X	X	X	X
Indigo							X
Catbird				X			
Chickadee, Black-capped					X		
Cowbird, Brown-headed	X	X	X	X	X	X	X
Crow, Common	X	X	X	X	X	X	X
Dove, Mourning	X	X	X	X	X	X	X
Rock		X				X	X
Eagle, Golden	X	X	X	X		X	X
Egret, Snowy					X		
Falcon, Prairie	X	X	X	X		X	X
Flicker, Common		X	X	X	X	X	X
Goldfinch, American					X		
Grackle, Common		X		X	X	X	X
Grouse, Sharp-tailed	X	X	X	X	X	X	X
Hawk, Ferruginous	X	X					
Marsh	X	X	X	X	X	X	X
Red-tailed	X	X	X	X	X	X	X
Rough-legged	X	X	X	X		X	X
Sharp-shinned		X					
Swainson's	X	X	X	X	X	X	X
Kestrel, American	X	X	X	X	X	X	X
Killdeer	X	X	X	X	X	X	X
Kingbird, Eastern	X	X	X	X	X	X	X
Western	X	X	X	X	X	X	X
Lark, Horned	X	X	X	X	X	X	X
Longspur, Chestnut-collared		X	X	X	X	X	X
McCown's		X					
Magpie, Black-billed	X	X	X	X	X	X	X
Meadowlark, Western	X	X	X	X	X	X	X

Species	Year						
	1966	1967	1968	1969	1970	1971	1972
Nighthawk, Common	X	X	X	X	X	X	X
Oriole, Northern					X		
Orchard		X		X	X	X	X
Owl, Burrowing	X					X	X
Great Horned		X	X	X	X	X	X
Short-eared							X
Phoebe, Say's						X	X
Pipit, Water						X	X
Sprague's						X	
Pheasant, Ring-necked	X		X	X	X	X	X
Robin, American			X	X		X	X
Shrike, Loggerhead	X	X	X	X	X	X	X
Northern							X
Sparrow, Chipping						X	
Grasshopper		X	X	X	X	X	X
House			X	X			
Lark		X		X	X	X	X
Savannah		X					
Tree						X	
Vesper	X		X	X	X	X	X
White-crowned		X			X		
Starling	X		X	X	X	X	X
Swallow, Barn		X	X	X	X	X	X
Cliff		X	X	X	X	X	X
Swan, Trumpeter					X		X
Thrasher, Brown	X	X	X	X	X	X	X
Towhee, Rufous-sided	X			X			
Vulture, Turkey	X	X	X	X		X	X
Warbler, Yellow					X		
Woodpecker, Hairy				X			
Redheaded						X	X
Wren, Rock				X			
Total species each year	29	40	34	42	38	46	46

Total species = 66

Table 4.—Peak number of young waterfowl observed on each pond (number of broods in parentheses)

Pond	Year							Total
	1966	1967	1968	1969	1970	1971	1972	
A	0(0)	0(0)	1(1)	0(0)	2(1)	3(1)	7(2)	13(5)
B[1]	2(1)	9(2)	2(1)	22(3)	0(0)	4(1)	0(0)	39(8)
J[2]	6(1)	9(1)	22(4)	0(0)	7(1)	6(1)	0(0)	50(8)
H[2]	0(0)	0(0)	2(1)	5(1)	42(6)	7(2)	23(5)	79(15)
L	14(2)	24(6)	14(3)	4(1)	18(3)	14(4)	6(1)	94(20)
K[2]	0(0)	44(8)	11(3)	10(2)	10(1)	34(8)	13(2)	122(24)
E	47(7)	11(1)	18(5)	1(1)	13(2)	38(7)	20(5)	148(28)
F	46(5)	18(3)	7(2)	19(5)	28(5)	20(3)	12(2)	150(25)
G	13(4)	63(10)	21(4)	1(1)	7(1)	43(8)	19(3)	167(31)
C	27(4)	17(2)	18(4)	31(6)	7(1)	41(8)	36(10)	177(35)
D	40(6)	28(4)	53(7)	16(4)	30(6)	15(3)	14(3)	196(33)
I	16(3)	64(7)	58(10)	10(2)	84(11)	6(2)	24(3)	262(38)
Total	211(33)	287(44)	227(45)	119(26)	248(38)	231(48)	174(36)	1497(270)

[1]Fenced in 1961.

[2]Fenced in 1969.

Difference in behavioral patterns were observed between blue-winged teal and mallard broods. Blue-winged teal swam to the center of the pond when our presence was detected, while mallard broods headed for shoreline cover. Blue-winged teal tolerated other blue-winged teal broods on a pond; seldom was more than one mallard brood observed on one pond (fig. 5).

Data were not sufficient to correlate brood production with the highly variable vegetation conditions. Factors influencing vegetation characteristics included rapidly changing water levels and livestock grazing pressures. Livestock frequently entered most fenced exclosures.

Ponds A, B, H, and J had low duck production. Steep shorelines on B and J reduced the shallow water area and thus brood habitat. Shorelines on ponds A and H were heavily grazed at the start of the study, and waterfowl production was low. Pond H was not grazed in the springs of 1970 and 1972; vegetation cover and brood use increased in those years. Sparse aquatic vegetation and water level fluctuations that caused a large mud flat area on pond A made this pond better for shorebird use than for waterfowl nesting habitat.

The better producing habitat—ponds G, C, D, and I—were all between 2 and 7 acres, had flat to gently sloping shorelines, and common or abundant aquatic vegetation. The significance of these characteristics is discussed in the management alternatives section of this report.

Shorebirds and Other Waterbirds

Over the 7-year study period, 154 young upland sandpipers, long-billed curlews, Wilson's phalaropes, pied-billed grebes, and American coots were observed. Upland sandpipers, long-billed curlews, and killdeer were common and nested in the area on the uplands between ponds. These three shorebirds were grassland birds during the nesting season, and did not need specific habitat characteristics found around ponds. The pied-billed grebe and American coot preferred ponds with abundant aquatic and emergent vegetation.

Total Use

The 12 study ponds annually provided an average of 32,018 waterfowl days of use and 2,487 shorebird days of use (tables 5 and 6). Individual ponds had an average of 12 waterfowl using them during any visit during the summer. Adult waterfowl use of individual ponds was different from brood production. Total adult waterfowl use was higher on the larger ponds (7 to 11 acres). Bue et al. (1964) estimated that 200,000 waterfowl were produced annually on 20,320 stock ponds in South Dakota.

Figure 5.—Mallard and teal broods on a study pond.

Table 5.—Summary of waterfowl and shorebird use on 12 stock watering ponds in Jackson County, South Dakota

Year	No. visits	No. ice-free days	Shorebirds			Waterfowl		
			No. birds	Days use	Average no./ pond visit	No. birds	Days use	Average no./ pond visit
1966	15	214	122	1,741	0.7	1,740	24,824	9.7
1967	16	221	151	2,086	.8	3,010	41,576	15.7
1968	18	245	320	4,356	1.5	2,519	34,286	11.7
1969	17	227	169	2,257	.8	1,509	20,150	7.4
1970	16	220	149	2,049	.8	2,405	33,069	12.5
1971	16	219	155	2,122	.8	2,249	30,783	11.7
1972	15	233	180	2,796	1.0	2,539	39,439	14.1
Total	113	1,579	1,246	17,407	6.4	15,971	224,127	82.8
Av.	16	226	178	2,487	.9	2,282	32,018	11.8

Table 6.—Number of waterfowl and related species observed on 12 stock watering ponds in Jackson County, South Dakota

Species	Year							
	1966	1967	1968	1969	1970	1971	1972	Total
Bufflehead	4	3		4	11	1	6	29
Coot, American	12	118	79	15	17	118	60	419
Canvasback					13			13
Cormorant, Double-crested			2	1				3
Duck, Ring-necked		7	4	1	10	25	13	60
Ruddy	1	1	1		4	5	6	18
Gadwall	196	186	216	168	45	159	205	1,175
Goldeneye, Common				5				5
Goose, Canada				69	27	31	43	170
Grebe, Eared		1			3	8	2	14
Horned		1			1			2
Pied-billed	14	80	44	23	80	83	75	399
Western	1							1
Mallard	566	715	1,085	529	764	480	675	4,814
Merganser, Common	25	1	5	61	87	5	156	340
Hooded			1					1
Pintail	72	232	176	128	324	204	291	1,427
Redhead	4	42	1	26	57	23	198	351
Scaup, Lesser	19	15	13	25	25	24	57	178
Shoveler	34	20	28	15	15	56	29	197
Teal, Blue-winged	539	953	693	303	440	636	350	3,914
Green-winged	25	313	75	99	277	120	154	1,063
Widgeon, American	23	91	49	13	199	255	141	771
Unidentified Ducks	205	231	47	24	6	16	78	607
Total	1,740	3,010	2,519	1,509	2,405	2,249	2,539	15,971

Habitat Changes and Pond Succession

Grazing use by cattle had considerable effect on the vegetation in and around the study ponds over the study period. When the study began, the ponds were subjected to grazing throughout the summer (approximately 6 months). By 1969, the pastures containing the study ponds were managed by a deferred or rest-rotation grazing system. These systems periodically allowed the pond shorelines to be "rested" from grazing. Vegetation responded quickly to these rest periods (see table 1).

Two ponds not included in the 12 study ponds were built in early fall of 1969 and were full of water by mid-November. They were constructed in dry ravines dominated with western wheatgrass, blue grama, and contained some prairie rose (*Rosa woodsii*) and western snowberry (*Symphoricarpos occidentalis*). No pond-type vegetation was present before the dams were built, nor could their seeds or plant parts have washed in. However, during the following August, these plants were observed: green algae, duckpotato arrowhead, European waterplantain, common cattail, Sago pondweed, and a mudplantain

species. Plant succession progressed rapidly. By 1972 these ponds were well vegetated along the shoreline with some emergent and submersed vegetation. Additional species present in the fall of 1972 included: American pondweed, Ducksalad mudplantain, creeping spikesedge, slender spikesedge, willow spp., plains poplar, common barnyardgrass, and narrow-leaved waterplantain. Several of these species are important food and cover plants for waterfowl (table 7).

Gleason and Cronquist (1964) suggested that seeds cling to the feathers, bill, and feet of waterfowl and shorebirds. DeVlaming and Proctor (1968) studied seed viability of 23 aquatic or semiaquatic plants after passage through the intestinal tract of killdeer and mallards, however, and concluded that internal conveyance seems more probable than wind dispersion or transport on the external surface of birds. Possibly both external and internal transport account for the rapid succession on these ponds.

One blue-winged teal and three mallards first used these newly constructed ponds on May 26, 1970. The following year, use increased to 26 ducks on the 2 ponds. One young Gadwall was seen on July 30, 1971. In 1972, use increased to 104 waterfowl, including 3 broods containing 14 young, during 15 visits to the 2 ponds.

Management Alternatives

Pond Location

Best waterfowl ponds are located in areas of rolling topography and constructed to provide a shoreline slope of less than 20 percent. Ponds for brood production should be more than 1 acre with adequate watershed area to maintain permanent water. Fill for the dam should be taken from a rather small area to create a deep pool in front of the dam that will remain relatively free from emergent and aquatic vegetation for many years and hold water longer. The watershed should be well vegetated and maintained so runoff water is relatively free from sediment.

This and other studies indicate the importance of a variety of pond characteristics to provide needed habitat components for a variety of waterfowl and shorebirds. Examples of preferences include: shorebirds use mudflats; waterfowl broods prefer shallow water with aquatic and emergent vegetation; waterfowl in general prefer larger ponds (1 to 10 acres). Ideally, several ponds of varying size, depth, and shoreline condition should be constructed in an area.

Breeding Habitat

Abundant emergent vegetation in shallow water is needed for brood habitat. This condition develops naturally on ponds with gently sloping shorelines subjected to light grazing. Ponds do not need to be fenced to enhance waterfowl habitat under current rest-rotation grazing systems. The three study ponds categorized as having common emergent vegetation in 1966 produced more young than the other nine study ponds, which were categorized as having sparse emergent vegetation. Brood observations on pond B (steep shoreline, sparse emergent vegetation) were generally less than on other ponds. Aquatic vegetation seemed important to broods, but factors such as shoreline slope obscured any clearcut relationships.

One factor which warrants additional research is brood food. Bent (1951) listed general food habits of adult waterfowl, but said very little about young puddle ducks. Submerged aquatic vegetation plays an important role in providing habitat for many forms of invertebrates, which in turn are utilized as food by young waterfowl.

Waterfowl broods will travel a considerable distance overland to utilize a more favorable pond. Berg (1956) recorded brood movements from 0.38 to 1.02 miles, with an average movement of 0.71 mile.

Bue et al. (1952) concluded that female waterfowl selected the tallest, densest cover available. The broods in his study used ponds with grassy shorelines three to four times more than ponds with mudflat shorelines. Hamor et al. (1968) reported that good duck brood habitat contains about half open water and half emergent vegetation.

As an alternative to fencing, a rest-rotation grazing system utilizing already fenced pastures would undoubtedly be a less costly means of encouraging waterfowl production. Gjersing (1971) found both breeding pairs and broods increased in habitat given periodic relief from grazing. In our study, the vegetation in and around ponds became more lush, and appeared to be better for waterfowl production after rest-rotation grazing systems were implemented. Our vegetation analyses were insufficient to quantify rapid changes in cover and thus relate to brood production. On pond H, however, 82 percent of the broods counted in the 7-year study were produced during the 2 years the pond was protected from spring grazing.

Observations from this and other studies were used to develop a form to evaluate ponds with various sizes, shapes, and other characteristics for providing habitat for the production of waterfowl (inside back cover). This form can be used as a checklist in planning waterfowl habitat improvement projects, and for evaluating existing pond potential or past management programs. In aggregate, these individual component ratings indicate the potential value of a pond for providing duck brood habitat. Separately, they indicate habitat components that are lacking or inadequate and need improving.

Table 7.—Important food and cover plants for waterfowl on the Buffalo Gap National Grasslands (adapted from Martin et al. 1951, Muenscher 1944, and Fassett 1957).

Plant	Value as food or cover	Food parts consumed	Identification	Propagation	Habitat requirement
Sago pondweed or Fennelleaf pondweed	Excellent food, most important single waterfowl food plant.	Rootstalks, seeds, tubers.	Fanlike spreading of narrow leaves near water surface.	Regeneration from rootstalks, seeds and tubers.	Sandy mud, 2½-5 ft water, fresh water, can tolerate about 20 percent salinity.
Floatingleaf pondweed	Fair to good food.	Seed.	Numerous oval floating leaves, submerged leaves have bladeless leaf stalk.	Seed, rootstalks.	Fresh-water ponds and lakes at moderate depths, soft rich soils, acidity tolerance high.
Slender naiad	Excellent food.	Leafy parts, seed.	Narrow delicate serrate leaves with broad sheathing bases, awl-shaped seed, axial.	Transplant growing parts and seed.	Sandy bottoms in fresh water, pond margins.
Knotweeds, smartweed, fleeceflowers, cornbing	Good to excellent food.	Seed.	Semisubmerged, oval spikes of pink flowers.	Rootstalks, and seeds.	Fresh moderately acid or mildly alkaline water.
Bulrushes	Good cover, good to excellent food.	Seed.	Round-stemmed or leafy 3-angled forms.	Rootstalks, some by tubers.	Fresh to mildly brackish water, usually found in marshes, mud flats, or shallow water along shorelines.
Spikesedge	Good cover, good food.	Seed.	Round-stemmed, 1 to 28 inches tall.	Seed and rootstalks.	Marshes or moist places.
Cattail	Good cover, food.	Seed and rootstalks.	Long narrow leaves, club-like heads.	Seed and rootstalks.	Almost any wet place.
Muskgrass, stonewort	Good to excellent food.	All parts.	Tiny branches in whorls, musky odor, high in calcium, brittle.	Transplant.	Diverse habitats, real soil not required, alkaline or saline habitat preferred.
Watercress	Excellent food, some cover.	Seed and some parts of plant.	Divided leaves, small white flowers, seeds in pods, fleshy plant.	Seed and transplant cuttings.	Moist area, some require cool moving water.
Duckpotato	Fair food.	Tubers, seed.	White flowers in whorls of 3, arrow shaped leaves.	Seed and tubers.	Marshes, mud flats, shorelines, fresh to mildly brackish water.
Watercrowfoot or buttercup.	Indirectly very important as food value.	Harbors aquatic insects on which young waterfowl feed.	Submerged in water, some submerged leaves finely disected, white-petaled flowers, sometimes yellowish at base.	Seed.	Aquatic, submerged, ponds, lakes.
Watermilfoil or parrotfeather	Indirectly very important, fair food.	Seed and vegetative parts harbor aquatic insects on which young waterfowl feed.	Disected, compound leaves, flowers on emersed floating spikes.	Seed and transfer cuttings.	Aquatic, submerged, cool ponds.
Coontail	Indirectly very important, fair food.	Seed and vegetative parts harbor aquatic insects on which young waterfowl feed.	Freely branched submerged stems, leaves in whorls, disected with minute teeth, rootless.	Seed and transfer cuttings.	Aquatic, submerged, quiet ponds, muck, rich soils and water on pond bottoms.

Habitat for Migrating Waterfowl and Shorebirds

Migrating waterfowl preferred the large ponds. Study ponds E and F—11 and 10 acres, respectively —were used extensively by migrating waterfowl, including the divers. Willow and cottonwoods were beginning to dominate the shorelines of many of the fenced ponds by the end of the study. If this trend continues, the ring of woody plants around ponds may decrease their value to migrating species that prefer good visibility.

Shorebirds seek mudflats and water less than 6 inches deep during migration. In the past, late fall and early spring grazing have created these conditions for the spring migration period. These conditions exist for the fall migration around ponds that receive heavy summer livestock use. Because shorebird and waterfowl brood habitat are not always compatible, we suggest grazing management systems that encourage mudflats on smaller ponds; and lush shorelines, emergents, and aquatic vegetation in and around some of the large ponds (over 1 acre).

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Appendix

Plant Species Collected In and Near 12 Study Ponds in Jackson County, South Dakota

Scientific Name	Common Name
Alisma gramineum Gmel.	Narrowleaved waterplantain
Alisma plantago-aquatica L.	European waterplantain
Ammania coccinea Roth	Purple ammania
Bacopa rotundifolia (Michx.) Wettst.	Disk waterhyssop
Callitriche hermaphroditica L.	Water-starwort
Carex brevior (Dewey) Mack.	Sedge
Ceratophyllum demersum L.	Hornwort
Chara Vaill.	Stonewort
Echinodorus berteroi (Spreng.) Fassett	Bur head
Elatine triandra Schkuhr	Waterwort
Eleocharis acicularis R. & S.	Slender spikesedge
Eleocharis palustris (L.) R. & S.	Creeping spikesedge
Heteranthera limosa (SW.) Willd.	Ducksalad mudplantain
Juncus interior Wieg.	Inland rush
Limosella aquatica L.	Water mudwort
Marsilea mucronata A.Br.	Common pepperwort
Mirabilis linearis (Pursh) Hiemerl.	Narrowleaf four-o'clock
Myriophyllum exalbescens Fern.	Parrotfeather
Najas flexilis (Willd.) Rost. & Schmidt	Slender naiad
Plagiobothryus scopulorum (Greene) Johnst.	Popcornflower
Polygonum coccineum Muhl.	Swamp knotweed
Polygonum lapathifolium var. *salicifolium* Sibth.	Curltop ladysthumb
Potamogeton diversifolium Raf.	Waterthread pondweed
Potamogeton nodosus Poir.	American pondweed
Potamogeton pectinatus L.	Fennelleaf or Sago pondweed
Potamogeton richardsonii (Benn.) Rydb.	Richardson pondweed
Potamogeton zosteriformis Fern.	Flatstem pondweed
Ranunculus aquatilis L.	Watercrowfoot buttercup
Ranunculus longirostris Godr. (*R. circinathus* Sibth.)	Longbeak buttercup
Rorippa islandica (Oed.) Borbas	Marshyellow watercress
Rorippa sinuata (Nutt.) Hitchc.	Spreadingyellow watercress
Sagittaria cuneata Sheld.	Duckpotato arrowhead
Salix amygdaloides Anderss.	Peachleaf willow
Salix interior Rowlee	Sandbar willow
Scirpus acutus Muhl.	Tule bulrush
Scirpus validus Vahl.	Softstem bulrush
Trifolium dubium Sibth.	Suckling clover

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1977. Avian use of livestock watering ponds in western South Dakota. USDA For. Serv. Gen. Tech. Rep. RM-35, 11 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521.

Waterfowl use from 1966 through 1972 peaked during the spring of 1967 when study ponds averaged 29 birds each. The average spring migration peak was 16.5 waterfowl per pond. Mallards and blue-winged teal made up 64 percent of adult waterfowl observed. Spring shorebird numbers peaked approximately 1 month later than waterfowl. The number of puddle duck young per pond during the peak of the brood season averaged 18, and varied from 10 to 24. Over the 7-year study period (1966-1972), 116 species of birds were observed in the area; 66 were upland birds not dependent on water developments. Large ponds (1-11 acres) in rolling topography with gently sloping shorelines, constant water levels, and abundant emergent and submerged vegetation, are best for duck brood production. An evaluation form for duck brood habitat was developed. Management implications and alternatives are discussed.

Keywords: Waterfowl use, duck brood production, wetland habitat.

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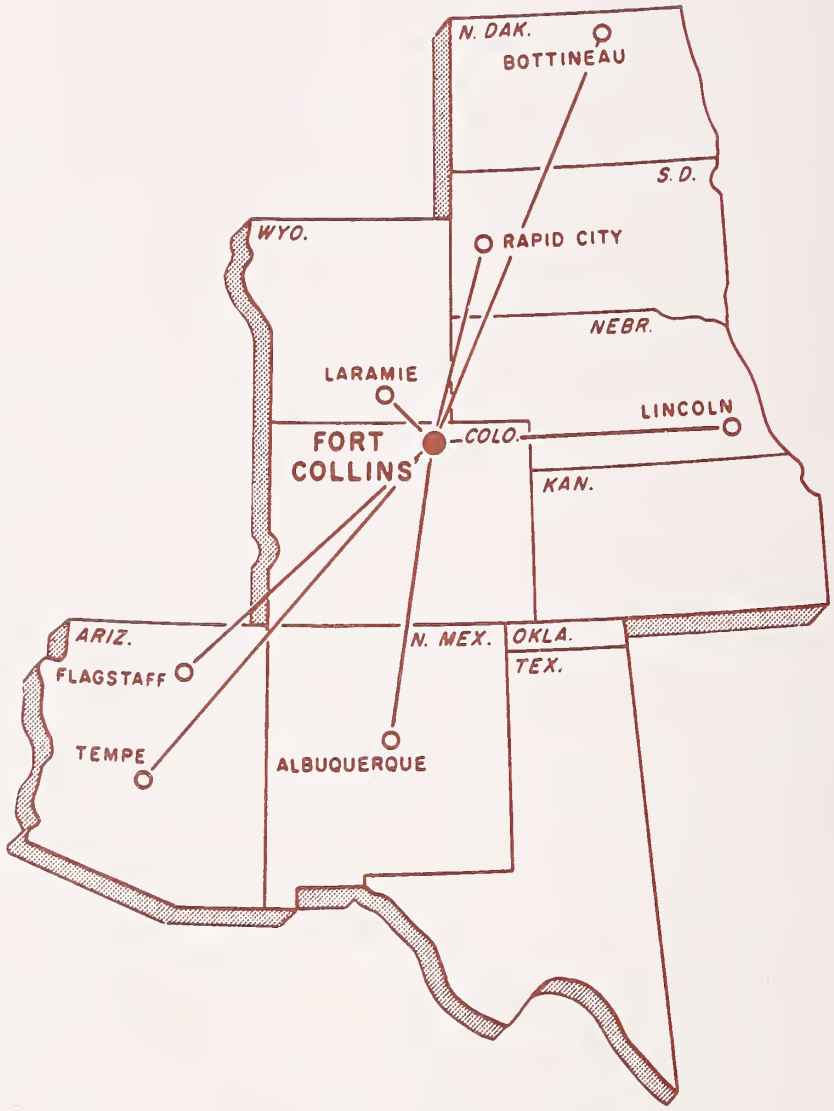
HABITAT EVALUATION FORM

Habitat Component	Rating
1. Size:	
A. Temporary water	Unsuitable
B. Permanent water, less than 1 surface acre	Inadequate
C. Permanent water, more than 1 surface acre	Good
2. Average shoreline slope, measured from existing water level:	
A. More than 3 feet per 5 horizontal feet	Unsuitable
B. 2-3 feet per 5 horizontal feet	Poor
C. 1-2 feet per 5 horizontal feet	Fair
D. 0-1 foot per 5 horizontal feet	Good
3. Shoreline vegetation within 10 feet of existing water level:	
A. 0-25 percent of the shoreline vegetation covered, or shoreline completely covered with tall rank vegetation with no open shoreline for brood resting sites	Unsuitable
B. 25-50 percent vegetation covered	Poor
C. 50-75 percent vegetation covered	Fair
D. Over 75 percent vegetation covered, except as in A	Good
4. Existing water conditions:	
A. Water level low with shoreline vegetation either absent or excessively trampled by livestock	Poor
B. Water level low with a good cover of shoreline vegetation, or pond approximately half full	Fair
C. Pond full or nearly full	Good
5. Food and cover plants (circle selected rank as follows: 0 = absent; 1 = rare; 2 = occasionaly; and 3 = common):	
A. Pondweed	0 1 2 3
B. Smartweed	0 1 2 3
C. Spikerush	0 1 2 3
D. Bulrush	0 1 2 3
E. Cattail	0 1 2 3
F. Naiad	0 1 2 3
G. Buttercup	0 1 2 3
H. Watermilfoil	0 1 2 3
I. Coontail	0 1 2 3
J. Stonewort	0 1 2 3
6. Emergent and aquatic vegetation (refer to ranking of plants in Item 5):	
A. No plant on list is ranked above the rare (1) category.	Unsuitable
B. No plant listed in A through D is ranked as common, but sufficient emergent and aquatic vegetation exists to rank some of the 10 listed species above the rare category. Less than 25 percent of the area of water less than 2 feet deep is occupied by listed plant species.	Poor
C. At least 1, and preferably 2, of the plants listed in A through D are common on the pond. Aquatic and emergent vegetation occupies 25-50 percent of the water area less than 2 feet deep.	Fair
D. There is a good variety, at least 5 of the plants listed, of the aquatic and emergent plant species occupying over half of the water area less than 2 feet deep (except as in E). Two or more of the species listed in A through D are common on the pond.	Good
E. Pond is completely or nearly completely covered with emergent and aquatic vegetation (choked).	Unsuitable


N. DAK.
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WYO.
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